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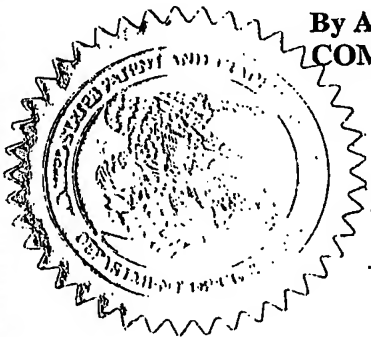
February 13, 2004

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OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT
APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A
FILING DATE.

APPLICATION NUMBER: 60/456,015

FILING DATE: March 19, 2003

RELATED PCT APPLICATION NUMBER: PCT/US03/38301



By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

M. Tarver

M. TARVER
Certifying Officer

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03/20/03 60456015 031903
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PROVISIONAL APPLICATION COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2).

Docket Number		60,152-944		Type plus sign (+) inside this box	+
INVENTOR(S)/APPLICANT(S)					
LAST NAME	FIRST NAME	MIDDLE INITIAL	RESIDENCE (CITY AND EITHER STATE OR FOREIGN COUNTRY)		
Woods	Harold	T.	45414 Augusta Drive Canton, Michigan 48188, USA		
TITLE OF THE INVENTION (280 characters max)					
SELF-DIAGNOSING PIERCE NUT INSTALLATION APPARATUS					
CORRESPONDENCE ADDRESS					
Raymond E. Scott The Pinehurst Office Center, Suite #101 39400 North Woodward Avenue Bloomfield Hills					
STATE	Michigan	ZIP CODE	48304-5151	COUNTRY	United States
ENCLOSED APPLICATION PARTS (check all that apply)					
<input checked="" type="checkbox"/> Specification		Number of Pages 16		<input type="checkbox"/> This applicant claims entitlement to Small Entity Status	
<input checked="" type="checkbox"/> Drawing(s)		Number of Sheets 5		Other (specify)	
METHOD OF PAYMENT (check one)					
<input checked="" type="checkbox"/> A check or money order is enclosed to cover the Provisional filing fees				PROVISIONAL FILING FEE AMOUNT	
<input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any filing fee deficiencies and credit any overpayments to Deposit Account Number: 08-2789				(\$) 160.00	
				CUSTOMER NO. 2789	

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.☐ Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

SIGNATURE

TYPED or PRINTED NAME Raymond E. Scott

Date March 19, 2003

REGISTRATION NO 22,981

(if appropriate)

☐ Additional inventors are being named on separately numbered sheets attached hereto

PROVISIONAL APPLICATION FILING ONLY

<h2 style="margin: 0;">FEE TRANSMITTAL</h2> <h3 style="margin: 0;">for FY 2002</h3> <p style="font-size: small; margin: 0;">Patent fees are subject to annual revision.</p>		Complete If Known	
<input type="checkbox"/> Applicant claims small entity status: See 37 CFR 1.27		Application Number	
		Filing Date	
		First Named Inventor	
		Examiner Name	
		Group Art Unit	
TOTAL AMOUNT OF PAYMENT		(\$) 160.00	
		Herewith March 19, 2003 Harold T. Woods Not Yet Assigned Not Yet Assigned 60,152-944	

METHOD OF PAYMENT (check all that apply) <input checked="" type="checkbox"/> Check <input type="checkbox"/> Credit Card <input type="checkbox"/> Money Order <input type="checkbox"/> Other <input type="checkbox"/> None <input type="checkbox"/> Deposit Account Deposit Account Number: <u>08-2789</u> Deposit Account Name: <u>Howard & Howard Attorneys, P.C.</u> The Commissioner is authorized to: (check all that apply) <input type="checkbox"/> Charge fee(s) indicated below <input checked="" type="checkbox"/> Credit any overpayments <input checked="" type="checkbox"/> Charge any additional fee(s) during the pendency of this application <input type="checkbox"/> Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account				FEE CALCULATION (continued)																																																																																																																																																																																																																																	
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late filing fee or oath		127	227	50	25	Surcharge - late provision filing fee or cover sheet		139	139	130	130	Non-English specification		147	147	2,520	2,520	For filing a request for <i>ex parte</i> reexamination		112	112	920*	920*	Requesting publication of SIR prior to Examiner action		113	113	1,840*	1,840*	Requesting publication of SIR after Examiner application		116	215	110	55	Extension for reply within first month		118	216	400	200	Extension for reply within second month		117	217	820	460	Extension for reply within third month		118	218	1,440	720	Extension for reply within fourth month		128	228	1,860	930	Extension for reply within fifth month		119	219	320	160	Notice of Appeal		120	220	320	160	Filing a brief in support of an appeal		121	221	280	140	Request for oral hearing		138	138	1,510	1,510	Petition to Institute a public use proceeding		140	240	110	55	Petition to revive - unavoidable		141	241	1,280	640	Petition to revive - unintentional		142	242	1,280	640	Utility issue fee (or reissue)		143	243	460	230	Design issue fee		144	244	620	310	Plant issue fee		122	122	130	130	Petitions to the Commissioner		123	123	50	50	Processing fee under 37 CFR § 1.17(q)		126	126	180	180	Submission of Information Disclosure Stmt		581	581	40	40	Recording each patent assignment per property (times number of properties)		146	246	740	370	Filing a submission after final rejection (37 CFR § 1.129(a))		149	249	740	370	For each additional invention to be examined (37 CFR § 1.129(b))		179	279	740	370	Request for Continued Examination (RCE)		169	169	900	900	Request for expedited examination of a design application		SUBTOTAL (2)				(\$) 0.00	
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SUBMITTED BY		Complete (if applicable)	
Name (Print/Type)	<u>Raymond E. Scott</u>	Registration No. (Attorney/Agent)	22,981
Signature	<u>Raymond E. Scott</u>	Telephone	248.723.0306
		Date	March 19, 2003

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Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

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CERTIFICATE OF EXPRESS MAILING

I hereby certify that the enclosed **PROVISIONAL PATENT APPLICATION** and fee are being deposited with the United States Postal Service as Express Mail, postage prepaid, in an envelope as "Express Mail Post Office to Addressee", Mailing Label No. **EV227251759US** and addressed to **Box Provisional Application**, Assistant Commissioner for Patents, Washington, D.C. 20231 on **March 19, 2003**.

Tracy L. Smith
Tracy L. Smith

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EXPRESS MAIL LABEL NO. EV227251759US

**SELF-DIAGNOSING PIERCE NUT
INSTALLATION APPARATUS**

Inventor(s): Harold T. Woods

Address: 45414 Augusta Drive
Canton, Michigan 48188, USA

Atty. Docket No.: 60,152-944

SELF-DIAGNOSING PIERCE NUT INSTALLATION APPARATUS

5

FIELD OF THE INVENTION

[00001] This invention relates to a pierce nut installation apparatus which continuously monitors the pierce nut installation and automatically shuts down the die press in the event that the last pierce nut is not properly installed.

10

BACKGROUND OF THE INVENTION

[00002] As will be understood by those skilled in this art, pierce nuts are typically installed in a metal plate or panel by an installation apparatus including a head generally attached to the upper die platen or shoe of a reciprocating die press and a die member or die button installed in the lower die shoe or die platen, wherein the panel is fixed to the lower die shoe or die platen overlying the die button. Pierce nuts are fed to the installation head opposite a reciprocating plunger which, upon closing of the die press, drives the pierce nut into the panel, piercing a slug from the panel, and the die button then installs the pierce nut in the pierced panel opening. The slug pierced from the panel is then received in an opening in the die button, which typically retains several slugs before ejecting the slugs.

[00003] The panel may be simultaneously formed by the die press and several pierce nuts may be simultaneously installed in the panel with each stroke of the die press particularly in mass production applications. On occasion, through misalignment or improper nut installation, the panel slug may remain attached or partially attached to the panel causing potential quality issues during the assembly operation, wherein the panel having the pierce nut attached is assembled to a second component. In the automotive industry, for example, the assembly operation is

carried out at a different location. Another problem associated with the installation of pierce nuts is the stacking of the panel slugs in the die button opening. The stack of slugs may "cold weld" together, forming a barrier to the entrance of further slugs and resulting in a poor or partial installation of the pierce nuts or requiring greater force to push out the slugs. It is not always possible to visually inspect the opening through the die button, particularly in time to shut down the die press to avoid improper installation of further pierce nuts. Further, the improper installation of the pierce nuts described above may not be discovered until later in the assembly process.

[00004] It would therefore be very desirable to monitor the pierce nut installations during the installation of the pierce nuts and simultaneously monitor the slugs pierced from the panel during installation. However, the prior art does not disclose an apparatus or method capable of continuously monitoring these problems and potential problems with the installation of pierce nuts.

15 SUMMARY OF THE INVENTION

[00005] The pierce nut installation apparatus of this invention is self-monitoring. That is, the pierce nut installation apparatus of this invention continuously monitors the installation of pierce nuts by the pierce nut installation head and the slugs pierced from the panel to assure continued proper installation of pierce nuts. The sensors in the pierce nut installation apparatus of this invention is connected to the computer logic of the die press. In the event that the sensor system determines that a pierce nut has not been installed in the panel or that a slug has not been pierced from the panel and received through the die button, the press is stopped at the top of the stroke for maintenance of the pierce nut installation head, permitting

immediate correction of the problem and avoiding incorrectly installed pierce nuts and potential scrap of the panel assembly.

[00006] The pierce nut installation head of this invention includes a plunger passage and a pierce nut feed passage intersecting the plunger passage. A feed mechanism feeds pierce nuts through the feed passage into the plunger passage opposite a reciprocating plunger in the plunger passage. Upon closing of the die press, the plunger reciprocates through the plunger passage to install a pierce nut in a panel supported on a die button as described above. A conventional pierce nut includes a projecting pilot portion, flange portions on at least opposed sides of the pilot portion and a bore extending through the pilot portion. The pilot portion pierces a slug from the panel and the die button deforms the panel metal adjacent the pierced panel opening into grooves in the pierce nut, permanently attaching the pierce nut to the panel. The pierced panel slug is then received in a central opening in the die button.

15 [00007] In a preferred embodiment of the pierce nut installation head of this invention, a slug probe rod is received through the plunger having a proximal end generally parallel to the proximal end of the plunger, opposite the pierce nut in the plunger passage when the die press is in the open position, and a distal end which is resiliently biased toward the proximal end of the plunger. The slug probe rod has an axial length greater than the axial length of the plunger such that, upon closing of the die press, the slug probe rod extends through the plunger into the pierce nut bore a distance greater than the thickness of the pierce nut if a slug has been pierced from the panel. If a slug has not been pierced from the panel, the proximal end of the slug probe rod will engage the panel. As will be understood by those skilled in this art, the distal end of the plunger of a conventional pierce nut installation head may be fixed to

or spaced from the back-up plate attached to the upper die platen. Upon closing of the die press, the distal end of the plunger engages the back-up plate and the proximal end of the plunger drives the pierce nut through the plunger passage. Because the slug probe rod has a greater axial length than the plunger and is resiliently biased toward the proximal end of the plunger, the proximal end of the slug probe rod is then received into the bore of the pierce nut to either engage the panel, if a slug has not been fully pierced from the panel, or through the nut bore if a slug has been pierced from the panel. The slug probe rod also serves the function of removing a slug from the panel in the event that a slug is partially pierced from the panel and hanging, for example, from the panel. A sensor of the pierce nut installation head then determines whether the slug probe rod has been received through the pierce nut bore and signals the computer logic of the die press to recycle the die press and install a second pierce nut. However, if the sensor determines that the slug rod probe has not been received through the pierce nut bore, the sensor signals the computer logic of the die press to stop the press when the press is open for inspection and maintenance as required.

[00008] In one preferred embodiment, the slug probe rod is mechanically biased toward the proximal end of the plunger by a conventional coil spring. In this embodiment, the distal end of the slug probe rod includes an enlarged head portion and the spring is biased against the enlarged head portion of the slug probe rod. In an alternative embodiment, the slug probe rod is resiliently biased toward the proximal end of the plunger by pneumatic pressure. In this alternative embodiment, the back-up plate includes a bore which receives an enlarged distal end of the slug probe rod has an O-ring or other sealing means and pneumatic pressure resiliently biases the slug probe rod toward the proximal end of the plunger. As used herein, the term "proximal" refers to a component or a portion of a component closest

to the pierce nut feed passage or the pierce nut in the plunger passage and the term "distal" refers to a component or a portion of a component furthest from the pierce nut feed passage or the pierce nut located in the plunger passage. As will be understood, these terms are for descriptive purposes only. In the disclosed embodiments, the pierce nut installation head of this invention includes a probe or sensor which senses the location of the distal end of the slug probe rod.

[00009] As set forth above, the self-monitoring pierce nut installation apparatus of this invention also determines whether a panel slug is received through the die button indicating that the panel has not only been pierced, but also that the pierced panel slug has been fully removed from the panel and received through the die button. In the current design of the pierce nut die button, the die button retains several slugs which, on occasion, can cold weld together, blocking the opening through the die button and resulting in improper installation of the pierce nuts or requiring greater force to remove the slugs. Another problem is that the slug may only be partially pierced from the panel and hangs from the panel. As set forth above, the pierce nut installation apparatus of this invention includes a slug sensor which determines whether the pierced panel slug is received through the central opening or bore in the die button.

[00010] The slug sensor is also connected to the computer logic of the die press. If a slug is received through the opening through the die button, the sensor signals the computer logic of the die press to recycle the press and install a second pierce nut as described above. If, however, the slug sensor indicates that a slug has not been received through the central opening of the die button, the sensor signals the computer logic of the die press to stop the press in the open position for corrective maintenance. In one embodiment of the pierce nut installation head of this invention,

the pierce nut installation head includes a sensor ring having an opening coaxially aligned with the opening through the die button and a conductive coil surrounds the opening of the ring sensor which creates a magnetic field which signals that a slug has been received through the opening through the die button. As will be understood, the conductive coil can also be located at the exit of the central opening of the die button. In an alternative embodiment, the sensor includes an infrared beam or similar sensing device which senses the ejection of the pierced panel slug.

[00011] As will be understood, the slug probe rod sensor and the slug sensor of the pierce nut installation apparatus of this invention may be utilized individually or in combination, but the preferred embodiment of the pierce nut installation head of this invention includes both features.

BRIEF DESCRIPTION OF THE DRAWINGS

[00012] Sheet 1, drawing No. D-131099, illustrates one embodiment of the pierce nut installation head of this invention;

[00013] Sheet 2, drawing No. D-129887, illustrates an alternative embodiment of the pierce nut installation head of this invention;

[00014] Sheet 3, drawing No. C-131121, illustrates one embodiment of an improved die button of this invention;

[00015] Sheet 4, drawing No. B-131311, illustrates a slug sensor assembly; and

[00016] Sheet 5 illustrates the sequence of installation of a pierce nut with the pierce nut installation apparatus of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[00017] Sheet 1 illustrates a pierce nut installation head of this invention including a top view shown in Figure 1, an end view shown in Figure 2, a perspective view shown in Figure 3 and a cross-sectional view shown in Figure 4 through section line Z-Z in Figure 1. Reference 1 in Figure 4 of Sheet 1 is a conventional nose assembly of a pierce nut installation head having a plunger passage 30 and a pierce nut feed passage 32 intersecting and communicating with the plunger passage 30. Pierce nuts (not shown in Sheet 1, but shown at 48 in Sheet 5) are fed through the feed passage 32 by a conventional feed assembly 8 having a feed pawl 34 when the die press (not shown) is opened. As will be understood by those skilled in this art, the base assembly includes a mounting block or back-up plate 4 which is attached to the upper die shoe or die platen of a conventional die press. The base assembly further includes a shank assembly 2 which is fixed to the nose assembly 1 by the chute attaching block lock pin 13 having a coil shank spring 9 which is biased against the upper die platen thereby normally spacing the nose assembly 1 from the base assembly 3 when the die press is opened. The base assembly further includes an inclined surface 36 and the feed assembly 8 normally includes a roller (not shown) which is received against the inclined surface 36, driving the feed assembly 8 to the right in Figure 4 when the die press is closed. The feed assembly 8 also includes a coil spring 38 which drives the feed pawl 34 to the left in Figure 4 or toward the nose assembly 1 when the die press is opened during feeding of a pierce nut from the feed passage 32 to the plunger passage 30. The pierce nut installation head further includes a reciprocating plunger 5 received in the plunger passage 40 of the cam base assembly 3 and 4 having a distal end 42 normally spaced from the back-up plate 4 by

spring 9. The proximal end 44 of the plunger 5 is normally located just above the plane of the feed passage 32 as shown in Figure 4.

[00018] Upon closing of the die press, the nose assembly 1 first engages a panel "P" supported on a die button 46 as shown in Sheet 5, Figure 1, which drives the nose assembly 1 toward the cam base assembly 3 and 4, against the force of the spring 9, which drives the proximal end 44 of the plunger against a pierce nut 48 in the plunger passage as shown in Figure 1 of Sheet 5 until the distal end 42 engages the back-up plate 4 as shown at Figure 2 of Sheet 5. Upon closing of the die press, the distal end 42 of the plunger 5 engages the back-up plate 4 and drives the pierce nut 48 into the panel P piercing a slug from the panel as shown in Figure 3 of Sheet 5 and the die button 46 then deforms the panel metal surrounding the pierced panel opening into grooves of the pierce nut 48 securing the pierce nut in the pierced panel opening. As thus far described, the pierce nut installation head may be conventional. Upon opening of the die press, the spring 9 drives the nose assembly toward the position shown in Figure 4 of Sheet 1 and the feed assembly 8 drives another pierce nut into the plunger passage 30, ready for installation. Although the pierce nut installation head thus far described is reliable for mass production applications, on occasion the panel slug shown in Figure 3 of Sheet 5 will not be severed or fully severed from the panel or retained in the die button resulting in an improper installation.

[00019] The pierce nut installation apparatus of this invention will immediately indicate either of these conditions and hold the die press in the open position for immediate diagnosis, maintenance or repair. The pierce nut installation head shown in Sheet 1 includes an elongated slug probe rod 22 which is telescopically received in a bore 50 through the plunger 5 having a proximal end 52 adjacent the

proximal end 44 of the plunger 5 and a distal end 54 received in an opening or bore 56 in the back-up or mounting plate 4 as shown in Figure 4 of Sheet 1. In this embodiment, a coil suspension spring 20 is biased between the enlarged head portion 54 of the slug probe rod 22 and the upper die show of the die press (not shown). As will be understood from the above description, the back-up plate 4 is mounted on the upper die platen of the die press (not shown) and thus the spring 20 is compressed between the upper die platen and the enlarged head 54 of the slug probe rod 22. In the preferred embodiment, the proximal end 52 of the slug probe rod 22 is generally parallel with, but preferably spaced upwardly from the proximal end 44 of the plunger 5 as shown in Figure 4 of Sheet 1. However, the slug probe rod 22 has an axial length greater than the axial length of the plunger 5. The pierce nut installation head of this invention further includes a proximity probe 19 which indicates the position of the enlarged head portion 54 of the slug probe rod and thus whether the slug probe rod is moved axially against the force of the spring 20. The proximity probe 19 is connected to the computer logic of the die press. In the event that the slug probe rod is driven distally into the bore 56 in the back-up plate 4 against the force of the spring 20, this indicates that a panel slug shown in Figure 3 of Sheet 5 has not been fully pierced from the panel. As shown in Figure 2 of Sheet 5, the proximal end 52 of the slug probe rod 22 is initially received into the bore of the nut 48 and against the panel P. However, when the panel is pierced, the proximal end 52 is received through the nut bore indicating that a slug has been pierced from the panel as shown in Figure 3 and a pierce nut has been installed in a panel. The spring biased slug probe rod 22 has an additional advantage of removing a slug from the panel if the slug is partially pierced from the panel and, for example, hanging from the panel at an obtuse angle relative to the plane of the panel. As set forth above, the proximity probe 19 is connected to the

computer logic of the die press. In the event that the proximal end 52 of the slug probe rod is not received through the bore of the nut 48 upon closing of the die press, the proximity probe 19 signals the computer logic of the die press and the computer logic of the die press will then indicate a "no go" situation and hold the press in the open position for maintenance or repair. As will be understood by those skilled in this art, the slug probe rod 22 may be used with any design of a pierce nut installation head and is not limited to the pierce nut installation head described.

[00020] As described further below, the proximity probe 19 may be replaced with an infrared sensor which eliminates the requirement for a wire from the proximity probe extending from the side of the head. In such embodiment, the slug probe rod 22 includes an axial bore with an infrared sensor located opposite the distal end 54 of the slug probe rod 54 which projects an infrared beam through the slug probe rod which is reflected off the panel in the event that a slug has not been pierced from the panel.

[00021] Sheet 2 illustrates an alternative embodiment of the pierce nut installation head shown in Sheet 1 wherein the primary modification relates to the slug probe rod which is numbered 33 in Sheet 2. In this embodiment, the plunger 5 is fixed to the punch support cam base 3 by a dowel pin 20 and the proximal end 60 of the slug probe rod 33 is approximately parallel to or spaced slightly above the proximal end 62 of the plunger 5 when the die press is open as shown in Figure 4 of Sheet 2. The slug probe rod 33 in this embodiment includes an enlarged cylindrical end portion 68 having cylindrical radial portions 70 and an O-ring 23 is received between the radial portion 70 and the assembly includes a molded urethane spring 16. Pneumatic pressure is received through port 13, which resiliently biases the slug probe rod 33 proximally against the force of the return spring 24. Except that the slug

probe rod 33 is resiliently biased by pneumatic pressure and the assembly includes a return spring 24, the function and operation of the slug probe rod 33 is identical to the slug probe rod 22 described above in regard to Sheet 1 of the drawings and therefore no further description is required for a full understanding of the pierce nut installation.

5 head shown in Sheet 2.

[00022] Sheet 3 illustrates an improved die button utilized with the self-diagnosing pierce nut installation apparatus of this invention, wherein Figure 1 of Sheet 3 is a side view of the die button, Figure 2 is a top view, Figure 3 is a cross-sectional view in the direction of view arrows B-B, Figure 4 is a cross-sectional side view of Figure 2 in the direction of view arrows C-C, and Figure 5 is a partial side cross-sectional view of Figure 2 in the direction of view arrows Z-Z. As shown in Figure 2, the die button includes a planar end face 72 having a projecting generally rectangular lip 74 having a sharp inner edge 76 which, in cooperation with the pilot portion of the pierce nut, pierces the slug from the panel. An opening 78 extends through the lip 74 and a central opening 80 extends through the die button as shown in Figure 1. The die button of this invention differs from the die buttons presently used in that the inner wall 78 is tapered radially outwardly from the lip 74 at a back angle of between 2 to 7 degrees or more, preferably 3 and 5 degrees, such that the panel slugs pierced from the panel shown in Figure 3 of Sheet 5 are not collected in the opening 78, but instead fall through the tapered opening into the main passage 80 assuming that the panel slug is fully pierced from the panel as described above. An angle of 3 to 5 degrees does not adversely affect the strength or integrity of the clinching lip 74 and has been found by experimentation by the Applicant to permit full ejection of the slug through the die button without decreasing the life of the die button, which has been a problem in many applications.

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[00023] Finally, Sheet 4 illustrates one embodiment of a slug sensor 82 also shown schematically in Sheet 5. The slug sensor assembly shown in Sheet 4 of the drawings includes riser plates 84 and 86 on opposed sides of a proximity ring sensor 88. The ring sensor includes a conductive metal coil 90 (shown in Sheet 5) which surrounds the opening 92 through the ring sensor 88. In the disclosed embodiment, the upper riser plate 86 includes a frustoconical opening 94 having a minor diameter generally equal to the diameter of the cylindrical bore 92 through the ring sensor 88 and the lower riser plate 84 includes a cylindrical opening 96 slightly larger than the cylindrical opening 92 through the ring sensor. The assembly is bolted to a suitable fixture by bolts 98, such that the openings 92, 94 and 96 are coaxially aligned with the opening through the die button as shown schematically in Sheet 5.

[00024] As will be understood by those skilled in this art, a metal part such as a panel slug received through the opening 92 of the ring sensor 88 will generate a magnetic field and the ring sensor 88 includes a connector 100 which is connected to the computer logic of the die press, such that the press shuts off in the event that a slug is not received through the opening 92 in the ring sensor. Of course, if a slug is received through the ring sensor 88, the press recycles as described above to install a second pierce nut or a plurality of pierce nuts in a second panel.

[00025] The self-diagnosing pierce nut installation apparatus of this invention thus senses whether a pierce nut has been installed in a panel and whether a slug has been fully pierced from the panel and automatically stops the press cycle in the event that a slug is only partially pierced from the panel or a pierce nut has not been installed in the panel. The die press is stopped in the open or upper position providing full access to the installation apparatus.

[00026] As will be understood by those skilled in this art, various modifications may be made to the self-diagnosing pierce nut installation apparatus of this invention within the purview of the appended claims. For example, the slug probe rod may be resiliently biased proximally by any suitable means including but not limited to a spring as shown in Sheet 1 and pneumatic pressure is shown in Sheet 2.

[00027] As described above, the proximity probe shown at 19 in sheet 1 and 25 in sheet 2 may be replaced by an infrared sensor, wherein the slug probe rod includes an axial bore therethrough and the assembly includes an infrared sensor opposite the distal end of the slug probe rod which projects an infrared beam through the slug probe rod. In the event that a slug has not been pierced from the panel, the infrared beam is reflected by the panel back to the infrared sensor to indicate whether a slug has been pierced from the panel. Alternative sensors may also be utilized. Further, the slug sensor shown in Sheet 4 of the drawings may be replaced with an infrared sensor or any suitable sensor which senses the passing of the slug through the opening 80 through the die button. Further, the conductive coil 90 may surround the opening 80 through the die button. Having described preferred embodiments of the pierce nut installation apparatus of this invention, the invention is now claimed as follows.

CLAIMS

1. A pierce nut installation apparatus for installing pierce nuts having a bore in a panel, comprising: a pierce nut installation head including a pierce nut feed passage, a plunger passage intersecting said feed passage receiving pierce nuts from
5 said feed passage, a plunger reciprocating in said plunger passage having a bore therethrough and a proximal end driving pierce nuts through said plunger passage into a panel opposite said plunger passage and piercing an opening in said panel, a slug probe rod reciprocally supported in said bore of said plunger resiliently biased toward
10 a panel in the event that an opening is not pierced in said panel, and a sensor sensing movement of said slug probe rod to determine whether an opening has been pierced in said panel.

2. The pierce nut installation apparatus as defined in Claim 1, wherein said slug probe rod has an axial length greater than an axial length of said plunger and
15 said slug probe rod having a proximal end adjacent said proximal end of said plunger prior to reciprocal movement of said plunger.

3. The pierce nut installation apparatus as defined in Claim 1, wherein said slug probe rod is spring biased toward said proximal end of said plunger.

4. The pierce nut installation apparatus as defined in Claim 1, wherein
20 said slug probe rod is resiliently biased toward said proximal end of said plunger by pneumatic pressure and said slug probe rod including a return spring biasing said slug probe rod away from said proximal end of said plunger.

5. The pierce nut installation apparatus as defined in Claim 1, wherein said slug probe rod has an enlarged distal end and said sensor detecting movement of
25 said enlarged distal end of said spring probe rod.

6. The pierce nut installation apparatus as defined in Claim 1, wherein said pierce nut installation apparatus includes a die button opposite said plunger passage supporting said panel having an opening coaxially aligned with said plunger passage and a slug sensor detecting receipt of a panel slug pierced from said panel and received through said opening in said die button.

7. The pierce nut installation apparatus as defined in Claim 6, wherein said slug sensor includes a conductive coil surrounding an opening in said sensor receiving said panel slug and said panel slug creating a magnetic field.

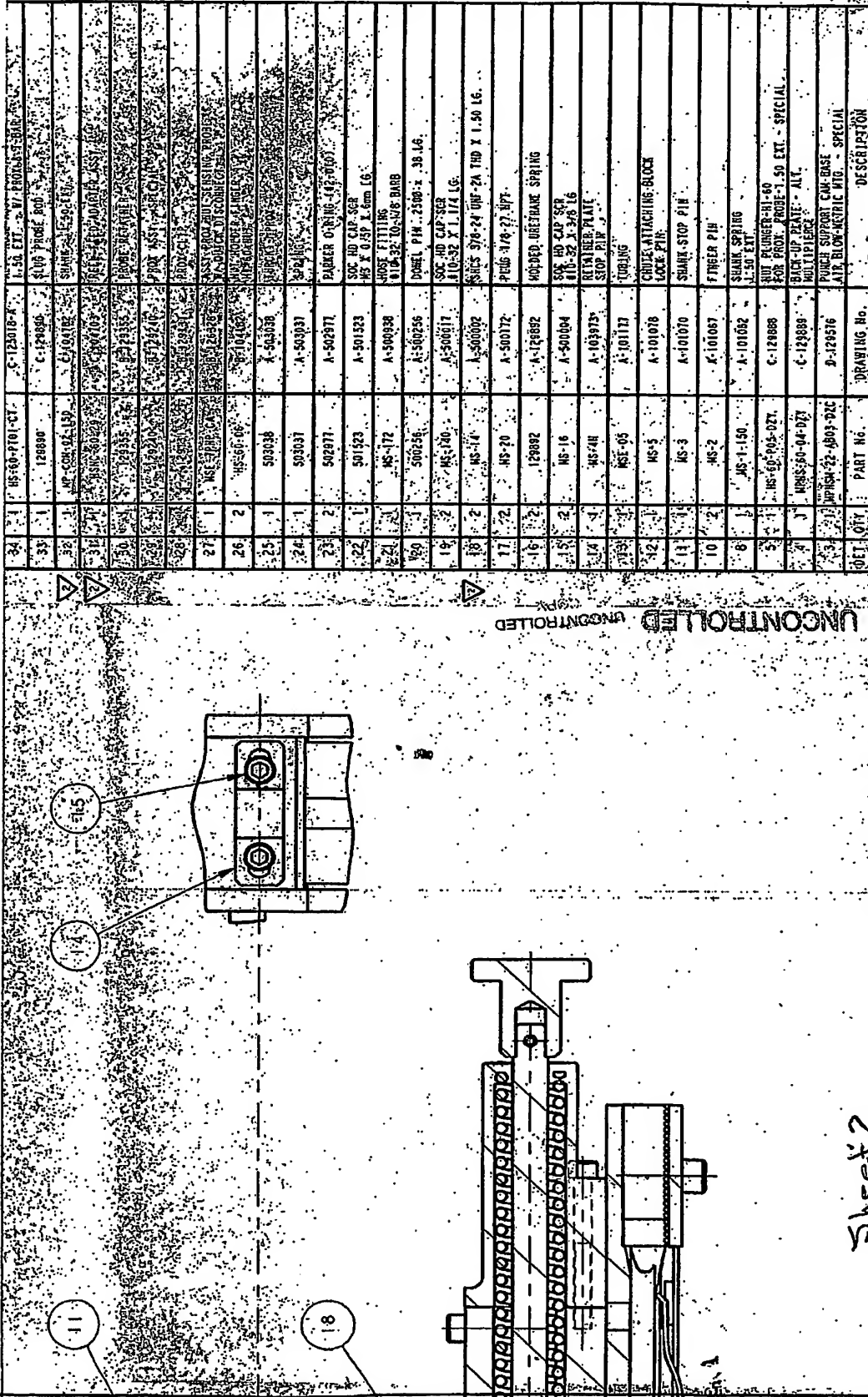
8. A pierce nut installation apparatus for installing pierce nuts having a nut bore in a panel, comprising: a pierce nut installation head including a pierce nut feed passage, a plunger passage intersecting said pierce nut feed passage receiving pierce nuts from said pierce nut feed passage, a plunger reciprocating in said plunger passage having a proximal end driving pierce nuts through said plunger passage into a panel opposite said plunger passage and said pierce nut piercing a slug from said panel forming an opening through said panel receiving said pierce nut, and a die button opposite said plunger passage supporting said panel having an opening coaxially aligned with said plunger passage and a slug sensor having an opening therethrough coaxially aligned with said opening through said die button detecting receipt of a panel slug pierced from said panel and received through said opening in said sensor.

9. The pierce nut installation apparatus as defined in Claim 8, wherein said sensor includes a conductive coil surrounding said opening through said sensor receiving said panel slug, said conductive coil creating a magnetic field upon receipt of said panel slug.

10. The pierce nut installation apparatus as defined in Claim 8, wherein said plunger includes a bore therethrough and a slug probe rod reciprocally supported in said bore of said plunger resiliently biased toward said proximal end of said plunger adapted to be received through said nut bore against said panel in the event
5 that an opening is not pierced in said panel, and a slug probe rod sensor sensing movement of said slug probe rod to determine whether an opening has been pierced in said panel.

11. The pierce nut installation apparatus as defined in Claim 10, wherein said slug probe rod has an axial length greater than an axial length of said plunger and
10 said slug probe rod having a proximal end adjacent said proximal end of said plunger prior to reciprocal movement of said plunger.

11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430	1431	1432	1433	1434	1435	1436	1437	1438	1439	1440	1441	1442	1443	1444	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	1459	1460	1461	1462	1463	1464	1465	1466	1467	1468	1469	1470	1471	1472	1473	1474	1475	1476	1477	1478	1479	1480	1481	1482	1483	1484	1485	1486	1487	1488	1489	1490	1491	1492	1493	1494	1495	1496	1497	1498	1499	1500	1501	1502	1
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DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED		INCHES	
1	PLACE DIMENSIONS (1, 2)	±.00	
2	PLACE DIMENSIONS (3, 4)	±.01	
3	PLACE DIMENSIONS (5, 6)	±.02	
4	PLACE DIMENSIONS (7, 8)	±.03	
5	PLACE DIMENSIONS (9, 10)	±.04	
6	PLACE DIMENSIONS (11, 12)	±.05	
7	PLACE DIMENSIONS (13, 14)	±.06	
8	PLACE DIMENSIONS (15, 16)	±.07	
9	PLACE DIMENSIONS (17, 18)	±.08	
10	PLACE DIMENSIONS (19, 20)	±.09	
11	PLACE DIMENSIONS (21, 22)	±.10	
12	PLACE DIMENSIONS (23, 24)	±.11	
13	PLACE DIMENSIONS (25, 26)	±.12	
14	PLACE DIMENSIONS (27, 28)	±.13	
15	PLACE DIMENSIONS (29, 30)	±.14	
16	PLACE DIMENSIONS (31, 32)	±.15	
17	PLACE DIMENSIONS (33, 34)	±.16	
18	PLACE DIMENSIONS (35, 36)	±.17	
19	PLACE DIMENSIONS (37, 38)	±.18	
20	PLACE DIMENSIONS (39, 40)	±.19	
21	PLACE DIMENSIONS (41, 42)	±.20	
22	PLACE DIMENSIONS (43, 44)	±.21	
23	PLACE DIMENSIONS (45, 46)	±.22	
24	PLACE DIMENSIONS (47, 48)	±.23	
25	PLACE DIMENSIONS (49, 50)	±.24	
26	PLACE DIMENSIONS (51, 52)	±.25	
27	PLACE DIMENSIONS (53, 54)	±.26	
28	PLACE DIMENSIONS (55, 56)	±.27	
29	PLACE DIMENSIONS (57, 58)	±.28	
30	PLACE DIMENSIONS (59, 60)	±.29	
31	PLACE DIMENSIONS (61, 62)	±.30	
32	PLACE DIMENSIONS (63, 64)	±.31	
33	PLACE DIMENSIONS (65, 66)	±.32	
34	PLACE DIMENSIONS (67, 68)	±.33	
35	PLACE DIMENSIONS (69, 70)	±.34	
36	PLACE DIMENSIONS (71, 72)	±.35	
37	PLACE DIMENSIONS (73, 74)	±.36	
38	PLACE DIMENSIONS (75, 76)	±.37	
39	PLACE DIMENSIONS (77, 78)	±.38	
40	PLACE DIMENSIONS (79, 80)	±.39	
41	PLACE DIMENSIONS (81, 82)	±.40	
42	PLACE DIMENSIONS (83, 84)	±.41	
43	PLACE DIMENSIONS (85, 86)	±.42	
44	PLACE DIMENSIONS (87, 88)	±.43	
45	PLACE DIMENSIONS (89, 90)	±.44	
46	PLACE DIMENSIONS (91, 92)	±.45	
47	PLACE DIMENSIONS (93, 94)	±.46	
48	PLACE DIMENSIONS (95, 96)	±.47	
49	PLACE DIMENSIONS (97, 98)	±.48	
50	PLACE DIMENSIONS (99, 100)	±.49	
51	PLACE DIMENSIONS (101, 102)	±.50	
52	PLACE DIMENSIONS (103, 104)	±.51	
53	PLACE DIMENSIONS (105, 106)	±.52	
54	PLACE DIMENSIONS (107, 108)	±.53	
55	PLACE DIMENSIONS (109, 110)	±.54	
56	PLACE DIMENSIONS (111, 112)	±.55	
57	PLACE DIMENSIONS (113, 114)	±.56	
58	PLACE DIMENSIONS (115, 116)	±.57	
59	PLACE DIMENSIONS (117, 118)	±.58	
60	PLACE DIMENSIONS (119, 120)	±.59	
61	PLACE DIMENSIONS (121, 122)	±.60	
62	PLACE DIMENSIONS (123, 124)	±.61	
63	PLACE DIMENSIONS (125, 126)	±.62	
64	PLACE DIMENSIONS (127, 128)	±.63	
65	PLACE DIMENSIONS (129, 130)	±.64	
66	PLACE DIMENSIONS (131, 132)	±.65	
67	PLACE DIMENSIONS (133, 134)	±.66	
68	PLACE DIMENSIONS (135, 136)	±.67	
69	PLACE DIMENSIONS (137, 138)	±.68	
70	PLACE DIMENSIONS (139, 140)	±.69	
71	PLACE DIMENSIONS (141, 142)	±.70	
72	PLACE DIMENSIONS (143, 144)	±.71	
73	PLACE DIMENSIONS (145, 146)	±.72	
74	PLACE DIMENSIONS (147, 148)	±.73	
75	PLACE DIMENSIONS (149, 150)	±.74	
76	PLACE DIMENSIONS (151, 152)	±.75	
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UNCONTROLLED

SECTION
Z-Z

Figure 4

Sheet 1.

3rd ANGLE
PROJECTION

•

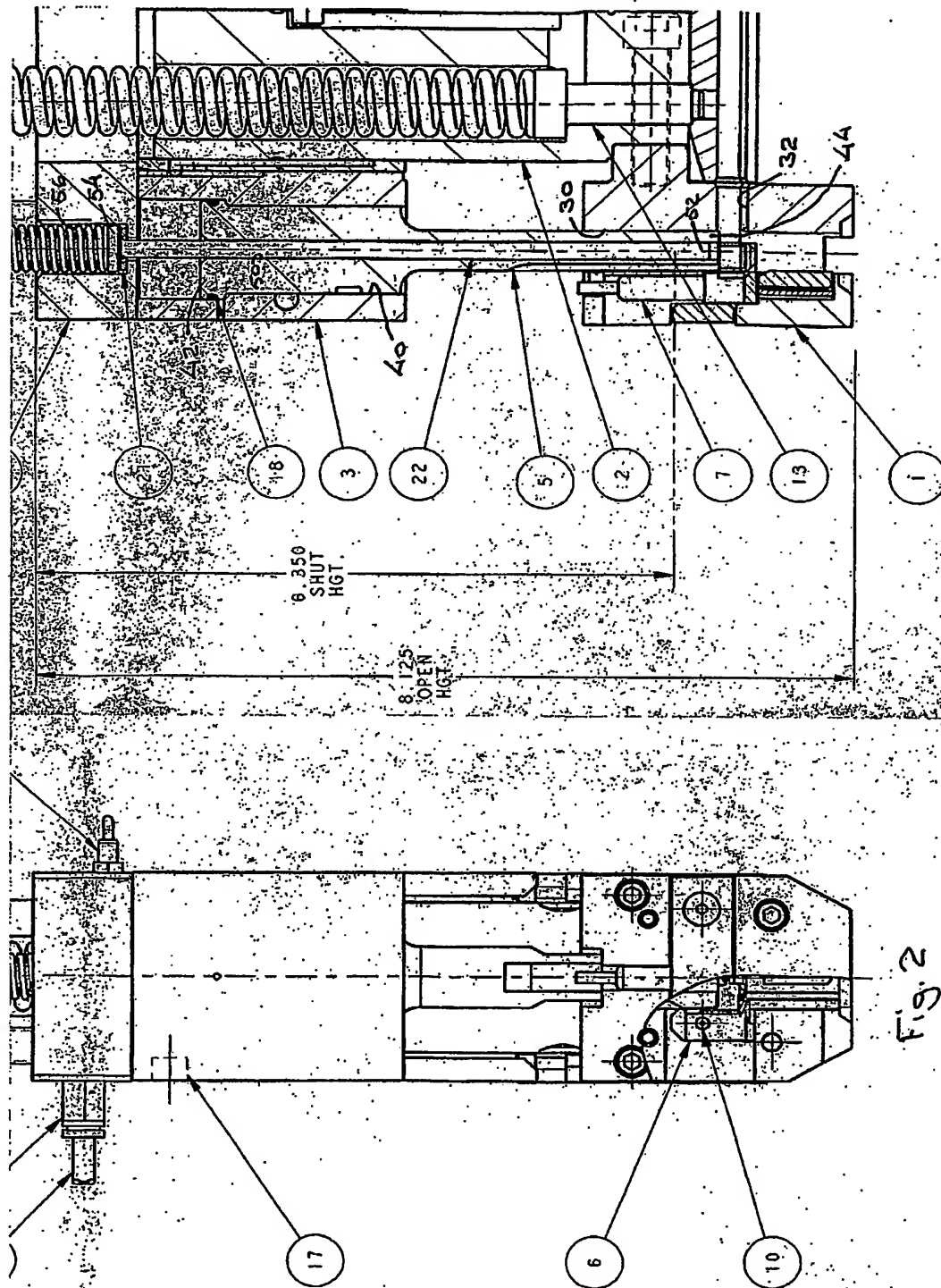


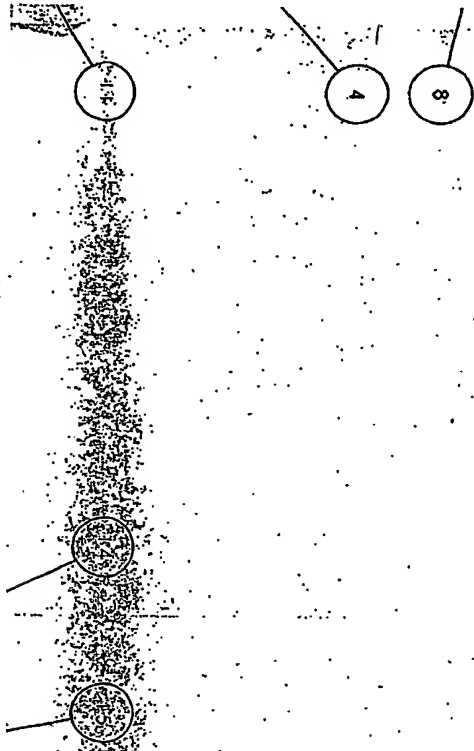
Fig. 2

NOT FURNISHED WITH HEAD ASSEMBLY
SHOWN FOR REFERENCE ONLY

PERMANENTLY AND LEGIBLY MARK "ASSY No." WHERE INDICATED

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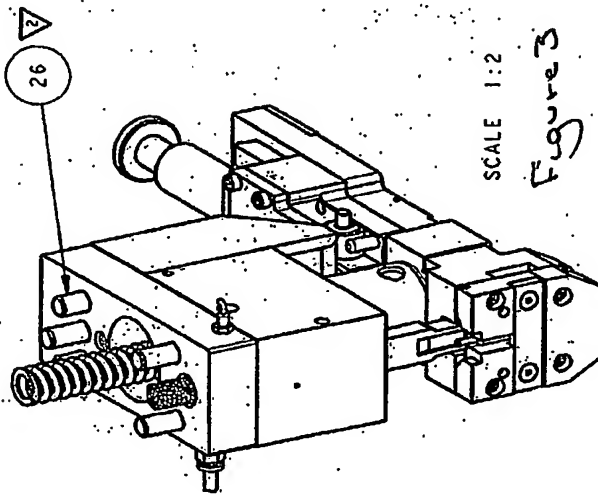
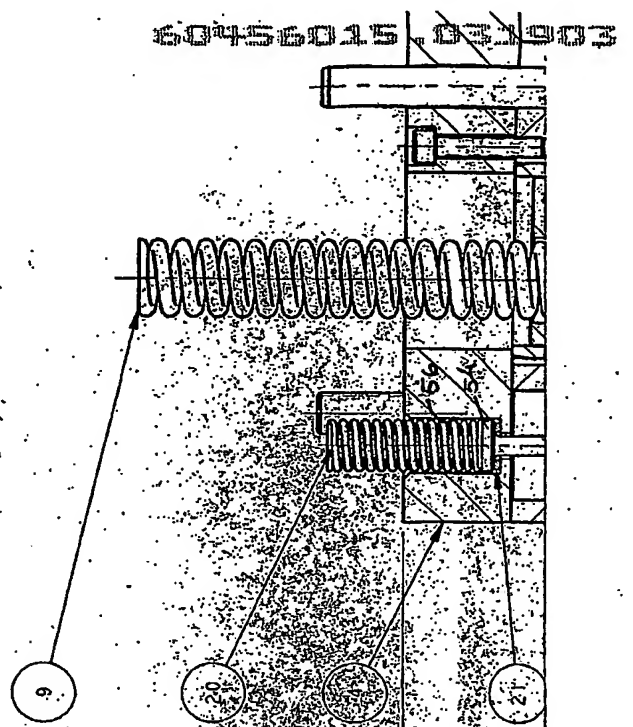
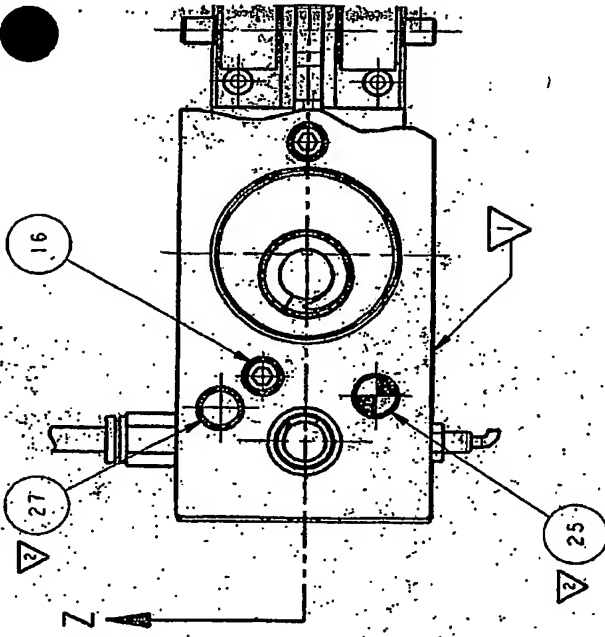
ALL GEOMETRIC DIMENSIONS & TOLERANCING IN ACCORDANCE WITH ASME Y14.5M-1994



LET.	F.C.H.	C.M.O.	CHARGE	BY	APPD	DATE

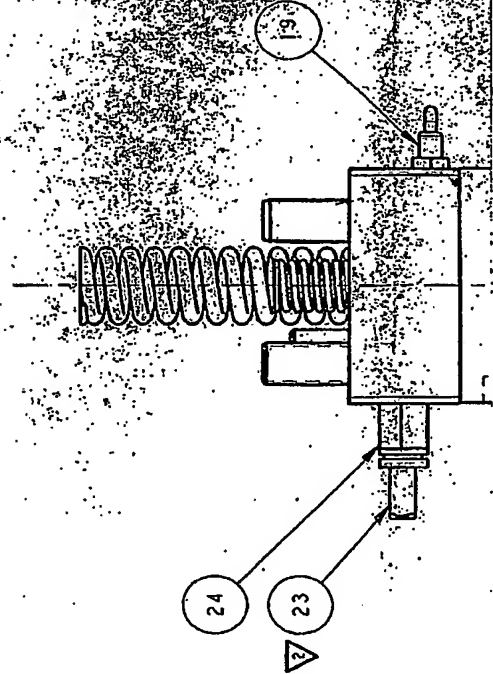
[illegible]

FOR GM LANSING



SCALE 1:2

Figure 3



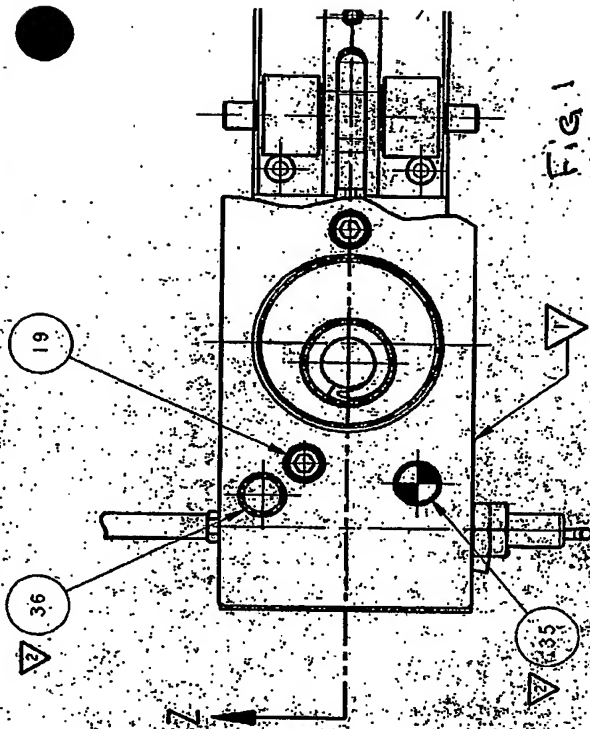


Fig. 1

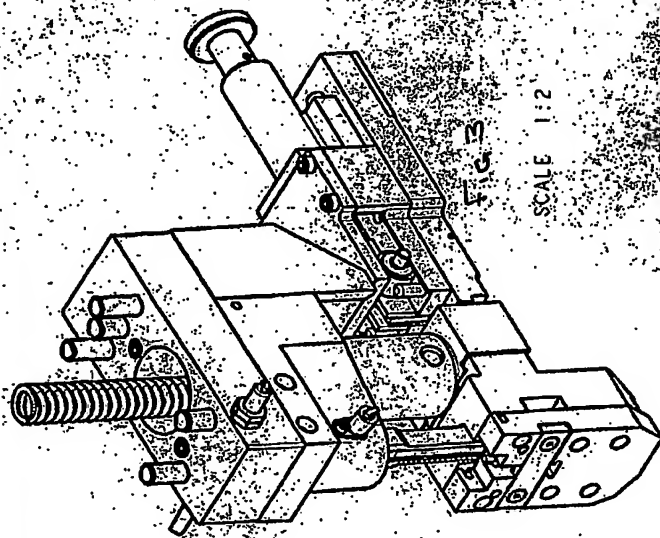
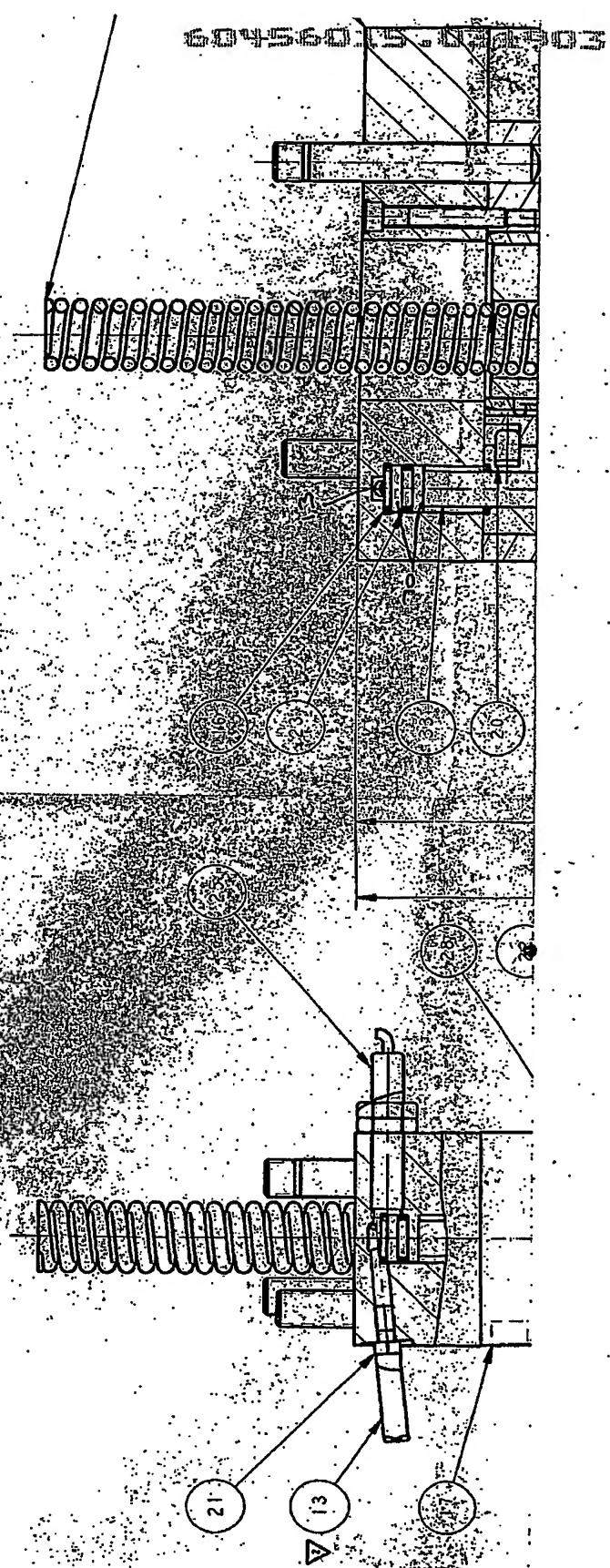
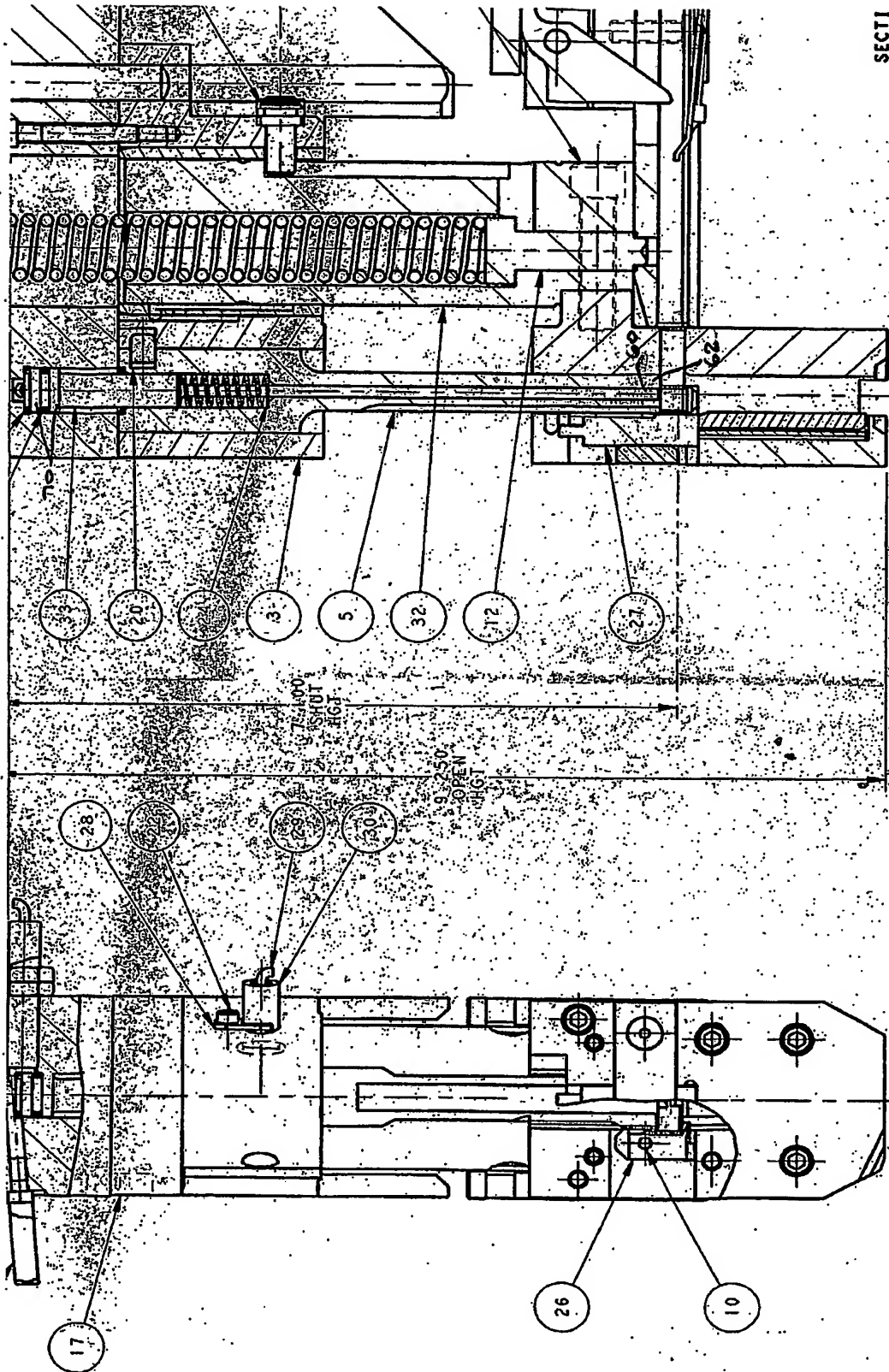


Fig. 3

SCALE 1:2





SECT I

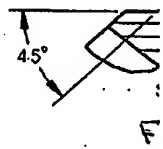
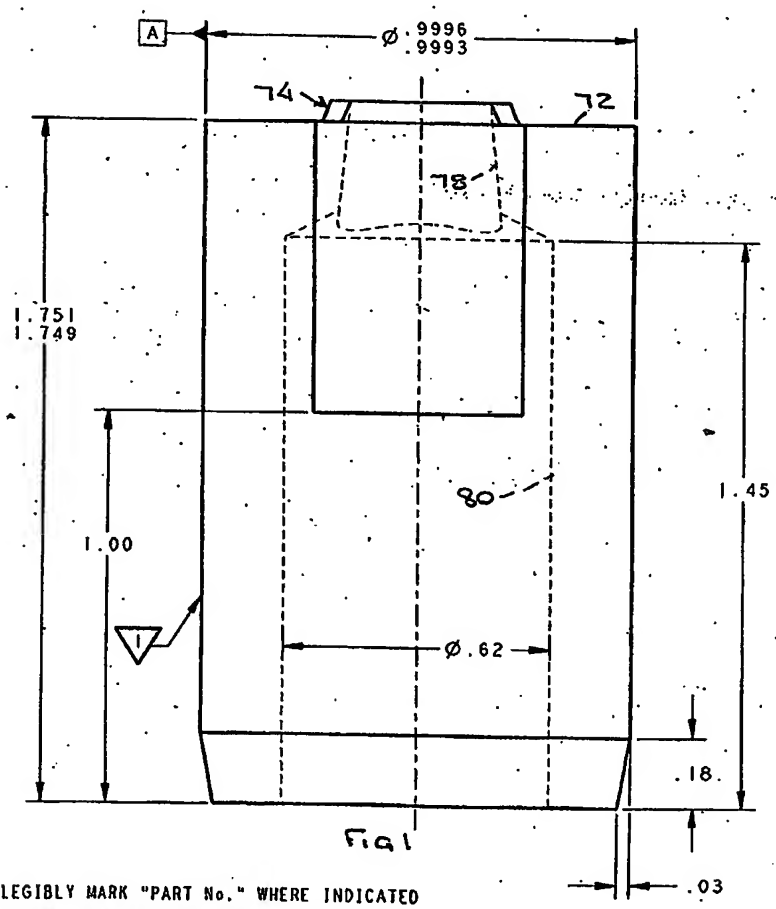
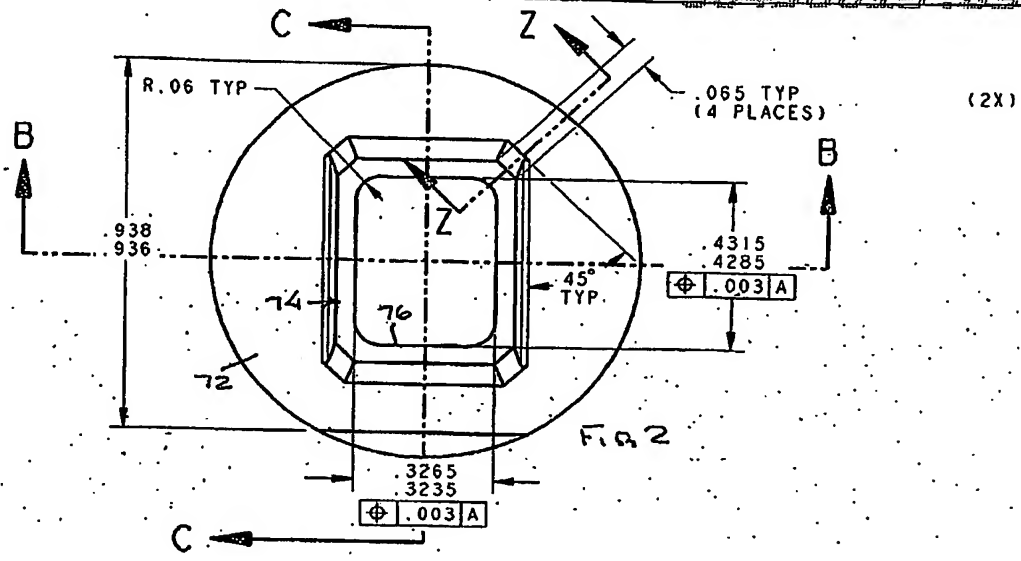
Fig. 2

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SHOWN FOR REFERENCE ONLY

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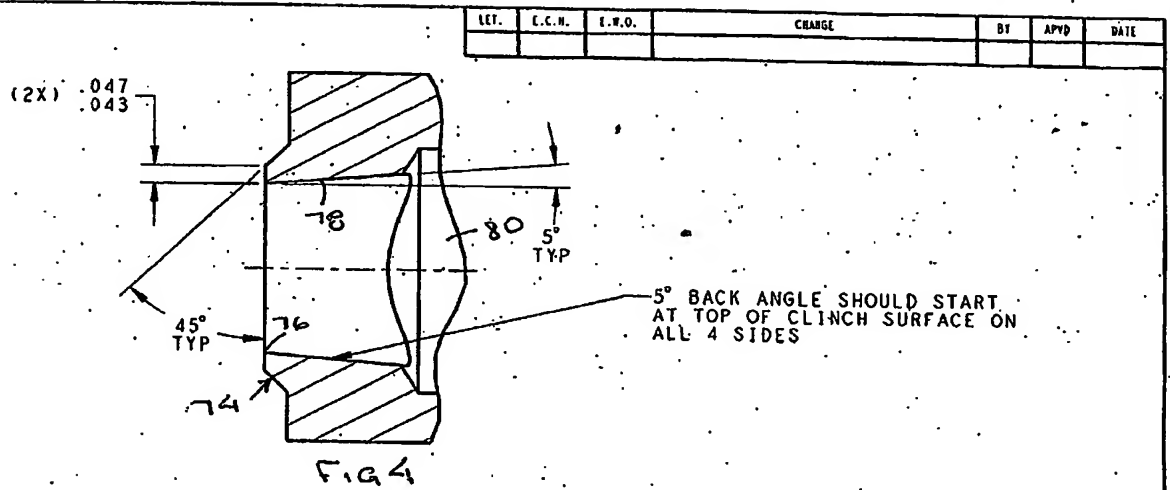
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ALL GEOMETRIC DIMENSIONS & TOLERANCES IN ACCORDANCE WITH ASME Y14.5M-1994

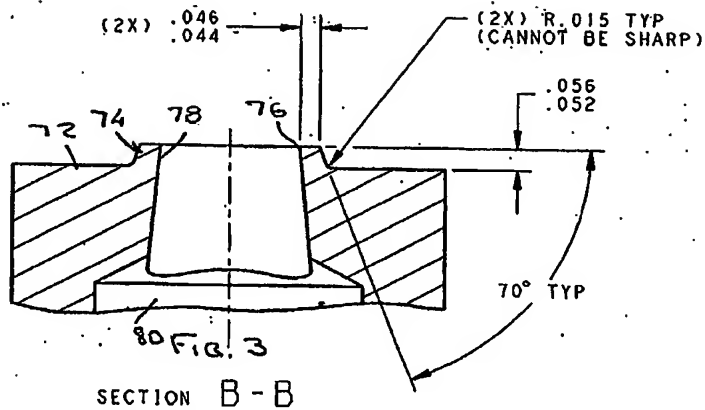
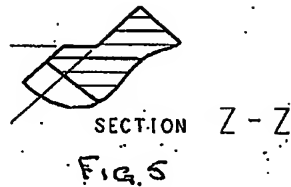


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SECTION C-C





SECTION B-B

Sheet 3

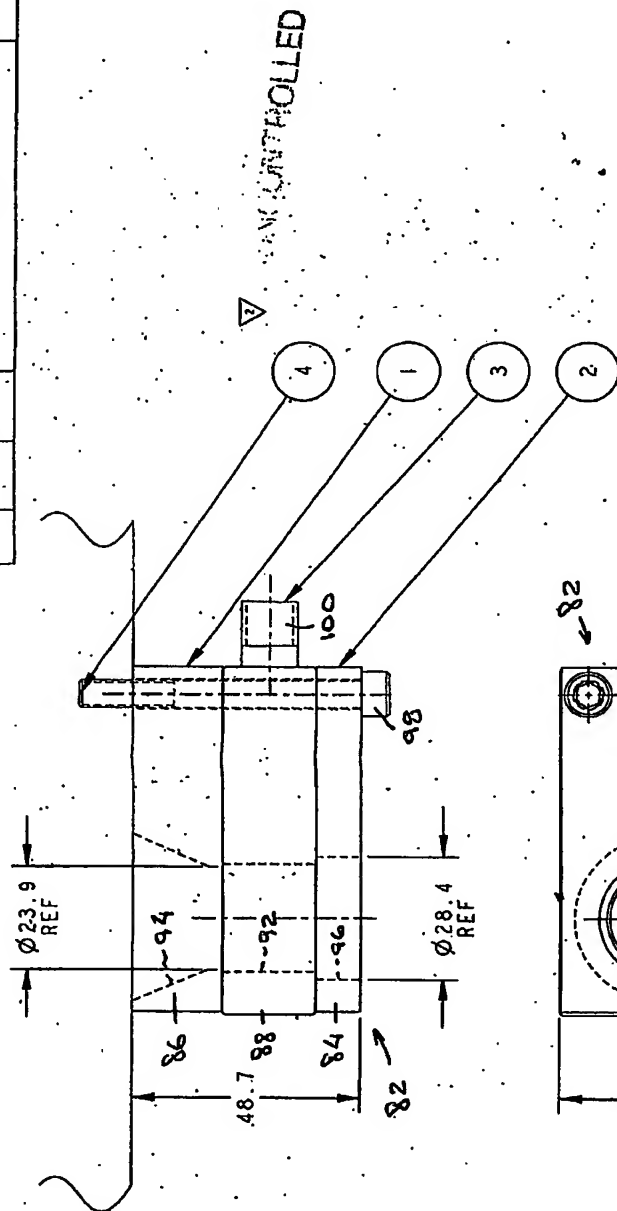
MAT'L - AISI S7 TOOL STEEL

UNCONTROLLED

DOUBLE DRAW
HARDEN: Rc 52-54

DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED		MM	INCHES	MULTIFASTENER® ENGINEERING				FABRISTEEL PRODUCTS INC. 22100 TROLLEY IND. DR. TAYLOR, MI 48160-1872	
1 PLACE DIMENSIONS (.X)	±0.25	±.06		DESCRIPTION DIE BUTTON-H160 FOR .025-.045 [.64-1.16] METAL		ASSY No.	UNITS ARE INCHES CAD IS THE MASTER	E.W.O.	SCALE 4:1
2 PLACE DIMENSIONS (.XX)	±0.13	±.01							
3 PLACE DIMENSIONS (.XXX)	±0.03	±.005							
ANGLES	±1°	±1°							
CENTRAL (.I.R.)	3.25	.010							
SURFACE FINISH	125 µm	.01 MAX							
REMOVE BURRS & BREAK ALL EDGES	0.25 MAX	±.0005							
LOCATION BETWEEN DOWELS	±0.013	±.005							
LOCATION BETWEEN SCREWS	±0.13	±.005							
3RD ANGLE PROJECTION				DRAWN BY G.M.	DATE 11-8-02	PART No.	DRAWING No.		
				CHKD BY CHAO	DATE 11-8-02				

LCI	E.C.N.	E.N.O.	CHANGE	BY	APPRO	DATE



Sheet 4

DET	QTY	PART No.	DRAWING No.	DESCRIPTION
4	2			SOC HD CAP SCR - M6 X 1.0P X 60mm LG
3	1	502976	A-502976	BALLUFF RING SENSOR
2	1	131308	B-131308	RISE PLATE - LOWER
1	1	131312	B-131312	RISE PLATE - UPPER

MULTIFASTER® ENGINEERING		FABRISTEEL PRODUCTS INC® 22100 TROLLEY IND. DR. TAYLOR, MI 48180-1872	
DESCRIPTION		SENSOR FOR SLUG DETECTION	
DRAWN BY G.M.		DATE 1-23-03	
CHECK		DATE 1-23-03	
APPRO		DATE 1-23-03	
PART No.		131311	
DRAWING No.		B-131311	

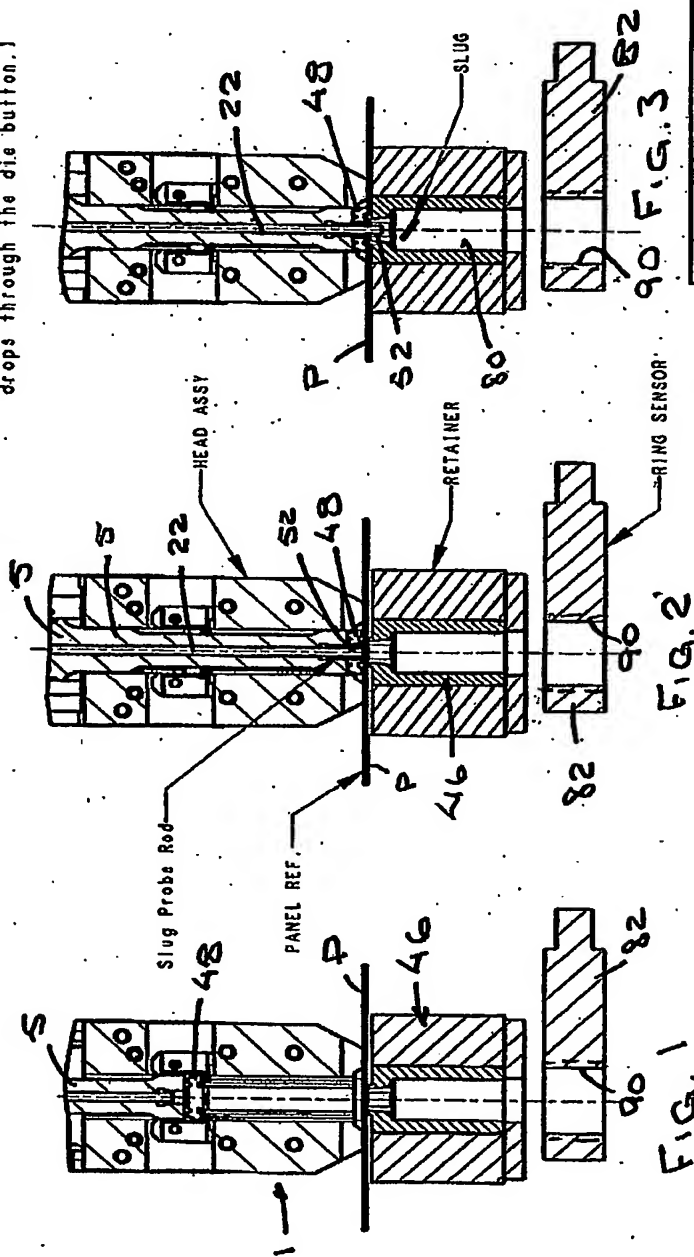
DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED	MM	INCHES
1 PLACE DIMENSIONS (.XX)	±0.25	±.01
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3 PLACE DIMENSIONS (.XXXX)	±0.08	±.003
4 PLACE DIMENSIONS (.XXXXX)	±0.05	±.002
5 PLACE DIMENSIONS (.XXXXXX)	±0.03	±.001
6 PLACE DIMENSIONS (.XXXXXX)	±0.02	±.0005
7 PLACE DIMENSIONS (.XXXXXX)	±0.01	±.0002
8 PLACE DIMENSIONS (.XXXXXX)	±0.005	±.0001
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10 PLACE DIMENSIONS (.XXXXXX)	±0.001	±.00002
11 PLACE DIMENSIONS (.XXXXXX)	±0.0005	±.00001
12 PLACE DIMENSIONS (.XXXXXX)	±0.0002	±.000005
13 PLACE DIMENSIONS (.XXXXXX)	±0.0001	±.000002
14 PLACE DIMENSIONS (.XXXXXX)	±0.00005	±.000001
15 PLACE DIMENSIONS (.XXXXXX)	±0.00002	±.0000005
16 PLACE DIMENSIONS (.XXXXXX)	±0.00001	±.0000002
17 PLACE DIMENSIONS (.XXXXXX)	±0.000005	±.0000001
18 PLACE DIMENSIONS (.XXXXXX)	±0.000002	±.00000005
19 PLACE DIMENSIONS (.XXXXXX)	±0.000001	±.00000002
20 PLACE DIMENSIONS (.XXXXXX)	±0.0000005	±.00000001
21 PLACE DIMENSIONS (.XXXXXX)	±0.0000002	±.000000005
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25 PLACE DIMENSIONS (.XXXXXX)	±0.00000001	±.0000000002
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50 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000005	±.000000000000000001
51 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000002	±.0000000000000000005
52 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000001	±.0000000000000000002
53 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000005	±.0000000000000000001
54 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000002	±.00000000000000000005
55 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000001	±.00000000000000000002
56 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000005	±.00000000000000000001
57 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000002	±.000000000000000000005
58 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000001	±.000000000000000000002
59 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000005	±.000000000000000000001
60 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000002	±.0000000000000000000005
61 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000001	±.0000000000000000000002
62 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000005	±.0000000000000000000001
63 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000002	±.00000000000000000000005
64 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000001	±.00000000000000000000002
65 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000005	±.00000000000000000000001
66 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000002	±.000000000000000000000005
67 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000001	±.000000000000000000000002
68 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000005	±.000000000000000000000001
69 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000002	±.0000000000000000000000005
70 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000001	±.0000000000000000000000002
71 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000005	±.0000000000000000000000001
72 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000002	±.00000000000000000000000005
73 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000001	±.00000000000000000000000002
74 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000005	±.00000000000000000000000001
75 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000002	±.000000000000000000000000005
76 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000001	±.000000000000000000000000002
77 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000005	±.000000000000000000000000001
78 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000002	±.0000000000000000000000000005
79 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000001	±.0000000000000000000000000002
80 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000005	±.0000000000000000000000000001
81 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000002	±.00000000000000000000000000005
82 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000001	±.00000000000000000000000000002
83 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000000005	±.00000000000000000000000000001
84 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000000002	±.000000000000000000000000000005
85 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000000001	±.000000000000000000000000000002
86 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000000005	±.000000000000000000000000000001
87 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000000002	±.0000000000000000000000000000005
88 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000000001	±.0000000000000000000000000000002
89 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000000005	±.0000000000000000000000000000001
90 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000000002	±.00000000000000000000000000000005
91 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000000001	±.00000000000000000000000000000002
92 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000000000005	±.00000000000000000000000000000001
93 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000000000002	±.000000000000000000000000000000005
94 PLACE DIMENSIONS (.XXXXXX)	±0.0000000000000000000000000000001	±.000000000000000000000000000000002
95 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000000000005	±.000000000000000000000000000000001
96 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000000000002	±.0000000000000000000000000000000005
97 PLACE DIMENSIONS (.XXXXXX)	±0.00000000000000000000000000000001	±.0000000000000000000000000000000002
98 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000000000005	±.0000000000000000000000000000000001
99 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000000000002	±.00000000000000000000000000000000005
100 PLACE DIMENSIONS (.XXXXXX)	±0.000000000000000000000000000000001	±.00000000000000000000000000000000002

NOT FURNISHED WITH ASSEMBLY
SHOWN FOR REFERENCE ONLY

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METRIC DIMENSIONING & TOLERANCING
IN ACCORDANCE WITH ASME Y14.5M-1994

1. When the Pierce Nut is automatically placed in the Installation Head, the "Slug Probe Rod" is in the "Start" position.
2. As the die closes, the Nut Plunger pushes the Pierce Nut Pilot through the Metal panel. The "Slug Probe Rod" contacts the "metal slug" and applies a pushing force to the slug.
3. The die-stamped blank (slug), cut by the Nut pilot, is pushed through the die button. A proximity probe, located in the installation Head, senses the position of the "Slug Probe Rod" at bottom of press stroke. Also, a proximity ring sensor, located at bottom of die button, senses the "Slug" as it drops through the die button.



Sheet 5

INSTALLATION HEAD

MULTIFASTER
ENGINEERING



FABRISTEEL PRODUCTS INC.
22100 TROLLEY IND. DR.
TAYLOR, MI 48180-1872